STATE OF SOUTH DAKOTA

FOREST HEALTH HIGHLIGHTS 2016

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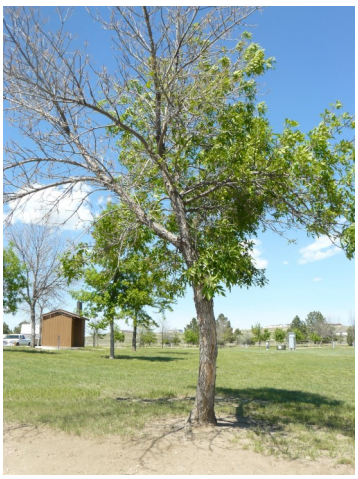
GENERAL OVERVIEW:

The most common tree species from which samples were submitted (either by mail or as pictures sent by email or text) or inspected during site visits was green ash (*Fraxinus pennsylvanica*) (23%). Green ash is one of the most common trees in South Dakota community forests and windbreaks. The discovery of emerald ash borer in the spring of 2016 in Nebraska also increased awareness and concern regarding the insect so more tree owners were looking for symptoms and signs of emerald ash borer infestations in their ash trees.

Colorado spruce (*Picea pungens*) was the second most common tree associated with samples (18%). This is also a very common tree in communities and windbreaks. There are also many spruce that are over-mature or planted too close together, and these stresses have resulted in decline of this species across the state. Other genera of trees that were seen in samples were pines (*Pinus*) (16%), elms (*Ulmus*) (9%), maples (*Acer*) (7%), juniper (*Juniperus*) (6%) and crabapple (*Malus*) (5%).



Declining green ash in Horsehead Campground at Angostura Recreation area near Hot Springs, SD (SDDA, 2009)

SAMPLES OVERVIEW:

- *Insects and mites that were confirmed in samples submitted or pictures sent as email or text attachments (p.2);*
- *Diseases that were confirmed in samples submitted or by pictures sent as email or text attachments (p.2);*
- *Disorders that were initially submitted as samples (either by mail or as pictures) and investigated in follow-up site visits (p.3);*
- *Most common woody plants submitted as samples (either by mail or pictures) for identification (p.3).*

SIXTH YEAR OF GOVERNOR'S BLACK HILLS INITIATIVE *(SEE MOUNTAIN PINE BEETLE HIGHLIGHT ON P. 5)*

2016 marked the sixth year of the SD Governor's Black Hills Initiative. Through this initiative, the SD Department of Agriculture's Division of Resource Conservation & Forestry (RCF) was tasked with surveying and marking mountain pine beetle (MPB) trees on private lands throughout the Black Hills, and creating a cost share incentive for landowners to treat the MPB infested trees.

The program focused on areas of high MPB infestation, and worked with landowners to reduce local MPB populations. Through partnerships with other agencies, MPB infestations were targeted across all Black Hills ownerships in the recent years of the program.

With the end of the epidemic in sight, this may be the final year of the program. Crews have already surveyed over 35,000 acres of private, state and federal lands, and found fewer than 2,000 infested trees as of December, 2016.

The efforts of RCF to reduce impacts to landowners during the epidemic was effective in priority areas where work was focused and followed up with thinning treatments. The program was widely regarded as a success.

CONFIRMED INSECTS & MITES

BY SAMPLES SUBMITTED OR PHOTOS VIA EMAIL OR TEXT

- Apple maggot (*Rhagoletis pomonella*)
- Ash/lilac borer (*Podosesia syringae*)
- Ash grey blister beetle (*Epicauta fabricii*)
- Ash seed weevils (*Lignyodes bischoffi*)
- Aspen twiggall fly (*Hexomyza schineri*)
- Banded elm bark beetle (*Scolytus chevyrewi*)
- Banded ash borer (*Neoclytus caprea*)
- Black blister beetle (*Epicauta pennsylvanica*)
- Black walnut erineum (*Eriophyes caulis*)
- Bronze birch borer (*Agrilus anxius*)
- Cedar borer (*Semanotus amplus*)
- Cottony ash psyllid (*Psyllopsis disrcepans*)
- Codling moth (*Cydia pomonella*)
- Cotoneaster leaf crumpler (*Acrobasis indigenella*)
- Eastern tent caterpillar (*Malacosoma americanum*), the western tent caterpillar (*M. californicum*) and the forest tent caterpillar (*M. disstria*)
- Elm calligrapha (*Calligrapha scalaris*)
- Fall webworm (*Hyphantria cunea*)
- Fall cankerworm (*Alsophila pometaria*)
- Flatheaded appletree borer (*Chrysobothris femorata*)
- Hackberry nipple gall maker (*Pachypsylla celtidismamma*)
- Lecanium soft scales (*Parthenolecanium*)
- Lilac root weevil (*Otiorhynchus meridionalis*) and black vine weevil (*O. sulcatus*)
- Maple bladder gall mite (*Vasates quadripedes*)
- May beetles (*Phyllophaga*)
- Metallic wood-borer (*Buprestis confluenta*)
- Pear slug (*Caliroa cerasi*)
- Plum curculio (*Conotrachelus nenuphar*)
- Spotted wing drosophila (*Drosophila suzukii*)
- Spruce needleminer (*Endothenia albolineana*)
- Walnut caterpillar (*Datana integerrima*)
- Willow gall midge (*Rhabdophaga strobiloides*)
- Willow sawfly (*Nematus ventralis*)
- Woolly aphids, both the woolly apple aphid (*Eriosoma lanigerum*) and the woolly elm aphid (*E. americanum*)

CONFIRMED DISEASES

BY SAMPLES SUBMITTED OR PHOTOS VIA EMAIL OR TEXT

- Apple scab (*Venturia inaequalis*)
- Ash rust (*Puccinia sparganioides*)
- Bacterial blight of lilac (*Pseudomonas syringae* pv. *syringae*)
- Black knot (*Apiosporina morbosa*)
- Buckeye rust (*Puccinia andropogonis*)
- Bur oak blight (*Tubakia iowensisi*)
- Cedar-apple rust (*Gymnosporangium juniperivirginianae*), cedar-hawthorn rust (*G. globosum*), and cedar-quince rust (*G. clavipes*)
- Cereal rust fungus (*Puccinia coronata*)
- Diplodia tip blight (*Diplodia pinea*)
- Dutch elm disease (*Ophiostoma novo-ulmi*)
- Fireblight (*Erwinia amylovora*)
- Juniper broom rust (*Gymnosporangium nidus-avis*)
- Kabatina twig blight (*Kabatina juniperi*)
- Marssonina blight (*Marssonina populi*)
- Peach leaf curl (*Taphrina deformans*)
- Pear scab (*Venturia pirina*)
- Phomopsis twig blight (*Phomopsis juniperovora*)
- Plum pockets (*Taphrina communis*)
- Tar spot (*Rhytisma acerinum*)
- Spruce needlecast, (*Stigmina lautii* and *Rhizosphaera kalkhoffii*)
- Willow scab (*Venturia saliciperda*)
- Walnut anthracnose (*Ophignomonia leptostyla*)
- Verticillium wilt (*Verticillium dahliae*)

Sample photos submitted, with follow-up site visits

- Chlorosis (*Acer rubrum, Betula nigra* and *Quercus palustris*)
- Improper planting (numerous species)
- Sunscald (*Acer*)
- Winter- burn (*Abies, Picea, Taxus* and *Thuja*)

Winter-burn on a fir (Dr. John Ball, 2013)

Woody Plant identification requests

- Cranberrybush viburnum (*Viburnum opulus*)
- Common buckthorn (*Rhamnus cathartica*)
- Staghorn sumac (*Rhus typhina*)
- Tamarisk (*Tamarix ramosissima*)
- Tatarian honeysuckle (*Lonicera tatarica*)

"[Common buckthorn]..is an invasive woody plant that has crowded out the native vegetation in our hardwood forests and also has invaded just about every East River shelterbelt." Dr. John Ball
Pest Update (June 1, 2016)
Vol. 14, no. 17

Highlighted Insect Conditions

Ash/lilac borer *(Podosesia syringae)*
This is a common borer of stressed ash trees and there has been an increase in reports of this insect during the recent drought and following the discovery of emerald ash borer in Nebraska. Ash/lilac borer infestations rarely result in significant mortality, however there have been ornamental plantings of Manchurian ash (*F. mandshurica*) and 'Northern Treasure' ash (black x Manchurian) were attacked and killed by this insect. Manchurian ash is being considered as a possible substitute for our native ash due to its tolerance to emerald ash borer infestations. However, its susceptibility to our native borer, and poor adaptation to dry climates, may limit its future use.

Cedar borer *(Semanotus amplus)*

This cerambycid beetle was discovered in declining eastern redcedar windbreaks in the central part of the state. According to the literature it is not found east of the Continental Divide, so this may be the first record of it in South Dakota. However, it is sometimes considered a subspecies of a *Semanotus* that is found throughout the country. Regardless, this borer does infest junipers (cedars) though it typically is found in dead and dying trees rather than healthy ones.

HIGHLIGHTED INSECT CONDITIONS (CONTINUED)

Emerald ash borer *(Agrilus planipennis)*

Emerald ash borer has not yet been found in South Dakota, but monitoring in parks and campgrounds with the purple prism traps continues throughout the state. The only Agrilus caught in the traps to-date are the bronze birch borer (*A. anxius*), honeylocust borer (*A. difficilis*) and hackberry borer (*A. celti*). Pest Detector workshops were held at three locations during the summer of 2016 and 43 people, mostly Master Gardeners, were trained in the detection of this insect and protocols for reporting a possible find. Tree owners reported 38 trees that they were concerned were infested by the emerald ash borer. All these trees, but one, were ash. All the ash were colonized by the redheaded (*Neoclytus acuminatus*) and banded ash borer (*N. caprea*) and the only insects submitted as possible emerald ash borers were the golden buprestid (*Buprestis aurulenta*).

EAB emerging from an ash log. (Brian Garbisch, 2014, Boulder, CO)

European elm leaf weevil *(Orchestes alni)*

Elm leaf beetles (*Xanthogaleruca luteola*) was once associated with the defoliation of elms, but this weevil, first reported in 2010, has become the primary defoliator of elms in the past three years. The weevil is generally found on Siberian elm (U. pumila).

Gall wasp *(Callirhytis flavipes)*

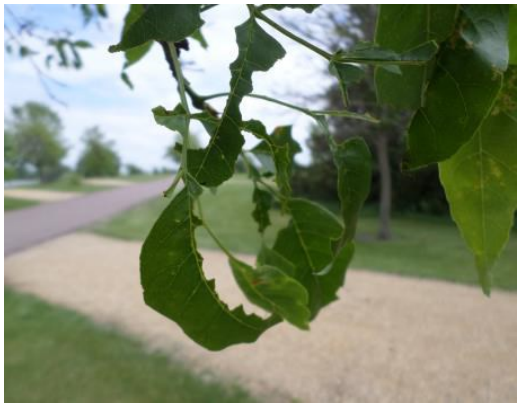
Bur oak serve as a host to a number of gall wasps and most colonization results in no damage or only minor twig dieback. The damage caused by this gall wasp is minor, but the mechanical injury caused by woodpeckers searching for the larvae beneath the bark can result in tree mortality. The woodpeckers shred most of the bark from young trees in their search for the insect, enough that the trees are killed by this injury. There were belts of young oaks with mortality as great as 50% from mechanical injury by the woodpeckers. The trees that are not killed by the woodpecker activity often have the tops killed back enough that the trees become misshaped and of little value as a windbreak tree. The injury has become so extensive that many producers are looking for another tree species to plant in their windbreaks.

Honeylocust borer *(Agrilus difficilis)*

This is a close relative to the emerald ash borer. It is native to the United States and it's only known host is honeylocust. The insect is not a common pest but we do see it in young, stressed honeylocust across the state. There are pinned samples of this insect in the SDSU insect museum caught in Kadoka back in 1920. The borer colonizes drought-stressed trees and hastens the decline by girdling the phloem tissue

May beetles *(Phyllophaga)*

Also known as June bugs, may beetles caused severe defoliation of ash across much of eastern South Dakota during June, 2016. The adults are shiny reddish-brown and about an inch long and stout. This insect spends most of its life underground as a C-shaped larvae, about 1 to 1 ½ inches long, feeding on the roots of grasses, crops, and other plants. The larvae require about three years to complete this life stage in the soil before pupating and emerge in the spring (May) as adults. The adults feed on the young leaves of many tree species, but seem to have an attraction to ash and oak. They do not defoliate nearby elms or hackberries. The adults are nocturnal so many tree owners wonder what has been chewing on their tree's leaves since they never see the insect. The adults are also a nuisance as they buzz around light fixtures at night so are common in the parking lots of convenience stores and gas stations.



May beetle defoliation on ash in an eastern SD campground (Dr. Ball, Pest Update June 8, 2016, Vol. 14, No. 18)

Highlighted Insect Conditions (continued)

Mountain pine beetle *(Dendroctonus ponderosae)*

The Forest Service land surrounding the border of the Sylvan Lake area of Custer State Park has been experiencing an epidemic since 2002, particularly within the Black Elk Wilderness Area. The Black Elk Wilderness Area bordering Custer State Park has experienced near 100 percent mortality by 2012. Custer State Park has seen lower pine mortality due to a multitude of management tactics such as thinning stands to reduce susceptibility and sanitation measures including removal of infested trees to cutting the infested trees into short sections and leaving in place. An estimated 1,000 trees were infested during the past flight (2016). As a comparison, there were about 110,000 tree killed from the 2011 flight, then 45,000 (2012), 30,000 (2013), 25,000 (2014), 5,000 (2015). Not only has the number of infested trees declined remarkably, the trees selected for attack differ. Where once the focus trees were large diameter pines, the attacks are now concentrated in smaller diameter, 6 to 9 inch dbh, trees or trees stressed by lightning or other abiotic agents.

Aerial view of Black Elk Peak looking east into the Black Elk Wilderness. Most mature pine have been killed by MPB, and the remaining green trees are Black Hills spruce and immature ponderosa pine. (Marcus Warnke, 2016).

Pine engraver beetles (*Ips spp.*)

Pine engraver beetle populations were very low during the past year but we have seen an increase in attacks on live trees in some stands. These localized population increases may be due to chipping slash following thinning operations. We have seen an increase in pine mortality in stands where the fresh slash has been chipped in early spring.

Red turpentine beetle *(Dendroctonus valens)*

Populations of red turpentine beetle have appeared to increase recently. The number of infested trees may not be increasing as much as being reported however, as infested trees are probably being identified more from landowners inspect trees for mountain pine beetle. We are also seeing an increase in turpentine beetles in stands that were chipped in the early spring and in areas with new home construction.

Lilac root weevil *(Otiorhynchus meridionalis)* and **black vine weevil** *(O. sulcatus)*

These insects were responsible for widespread defoliation of common lilacs throughout eastern South Dakota during the summer of 2016. These root weevils overwinter as mature larvae. The larvae feed in the soil on the roots of a wide range of plants from clover to spruce. The insect pupates in the spring with the adults emerging from the soil in June. The adult beetles are about 1/3 inch long with a long stout. They do not fly, but climb up on the plants at night to feed and lay eggs. If they are disturbed the adults quickly drop to the ground and hide.

The adults can also be a nuisances in in homes. They prefer moist environments so keeping the foundation of a home wet by watering flowers and shrubs next to the house encourages the insects to enter through broken screens and cracks.

HIGHLIGHTED DISEASE CONDITIONS

Bur oak blight *(Tubakia iowensisi)*

Bur oak blight, otherwise known as BOB, is showing up more along the woody draws in Sioux Falls. The disease was first noticed on bur oaks in southern Minnesota, Iowa, and eastern Nebraska back in the 1990s where it became associated with dying oaks.

The most common symptoms associated with the disease are leaves becoming discolored in late summer with purple-brown lesions appearing along the middle vein, yellow wedge shaped blotches on the leaf blade, and black pustules at the base of the petiole. The infected leaves tend to persist on the tree throughout much of the winter. The symptoms generally occur on the lower branches but during successive years intensify and eventually cover the entire canopy.

The disease is a leaf disease and infected trees will produce new leaves the following spring. However, infected trees are more susceptible to secondary stress agents such as two-lined chestnut borer and often begin showing extensive dieback after a few years of the initial symptoms and may die if the disease and the secondary stresses are left unmanaged. It is common to see only one or two trees in an oak grove expressing symptoms so there appears to be some variation in resistance to the disease. The disease is associated with the bur oak botanical variety *Quercus macrocarpa var. oliviformis* which is common to dry, upland sites. This variety is common in eastern South Dakota and produces slightly smaller acorns than most other bur oaks. Since the disease is specific to this subspecies of bur oak, we are not likely to see the disease appearing east of Highway 81 except along the Missouri River.

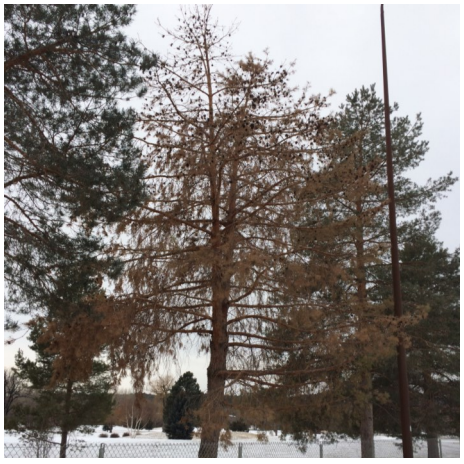
Bur oak leaf with symptoms of bur oak blight (Dr. John Ball, 2015).

Diplodia tip blight *[Diplodia pinea (Sphaeropsis pinea)]*

The disease was commonly reported throughout the state on Austrian and ponderosa pines in shelterbelts and community plantings.

Dutch elm disease *(Ophistoma novi-ulmi)*

Reports of this disease were few during 2016 as many communities already having suffered the loss of their elms during the past two decades. American elm still is a common street tree in the state, but appears more as isolated specimens than lining entire streets. This has reduced the incidents of root-graft infections.



Scotch pine in Rapid City, SD suspected of pine wilt mortality. (Marcus Warnke, 2016)

Pine wilt nematode *(Bursaphelenchus xylophilus)*

Pine wilt disease was first confirmed in South Dakota in 1989 along the Yankton-Lake Andes. During the 1990s it was confined to the extremely southern border of the state, but by the early 2000's it was detected in declining pines as far north as I-90. We now can find it as far north as Highway 212. The disease is vectored by sawyer beetles that carry the nematode from infected to healthy pines. The disease is most common in Scotch (*Pinus sylvestris*) and Austrian pine (*P. nigra*), but mugo pine (*P. mugo*) may also be killed by the disease. Our native ponderosa pine (*P. ponderosa*) appears not to be affected by the disease.

Pine wilt disease is not generally a serious problem in areas where the mean July temperature is less than 70°F. Watertown, the farthest north we have found the disease, had mean July temperatures in the high 60's back in the 1980s and 1990s. The mean July temperature is now in the low 70's. This may be why we are seeing the disease advance farther north in the past decade.

Highlighted Disease Conditions (continued)

Stigmina needlecast *(Stigmina lautii)*

This disease is still the dominant needecast disease of Colorado spruce. While there is still some needlecast samples submitted that were infected by Rhizophaera, the majority are Stigmina.

White pine blister rust on limber pine in Custer State Park. (Dr. John Ball, 2016)

White pine blister rust *(Cronartium ribicola)*

This disease was discovered in the relic stands of limber pine in the Cathedral Spires area of Custer State Park in the early 2000s. White pine blister rust is continuing to be a threat to the limber pines. While we have been conducting sanitation pruning on the lower infected branches, some infections still continue to appear in later years. Unfortunately, some of the infection has moved into the trunks of the trees and while we were able to prune out infected tops of some of the smaller trees and excise some cankers in the larger, the infection in some was impossible to remove.

We are also performing preventative pruning on some of the limber pines where all the branches are removed to a height of 7 feet or 40% of live crown. A novel approach we are considering is eliminating the Ribes from the Spires. The spores from pine can travel hundreds of miles, but the spore flight from the Ribes is measure in hundreds of feet. If we pull/spray enough Ribes from the Spires we may be able to slow the spread for a while.

The drought is also taking its toll on limber pines and white spruce along the west slope of the Spires. This was once a very shaded environment, but after the loss of ponderosa pine from mountain pine beetle and many of the white spruce to an ice storm, it has become a hotter, drier site.

Verticillium wilt *(Verticillium)*

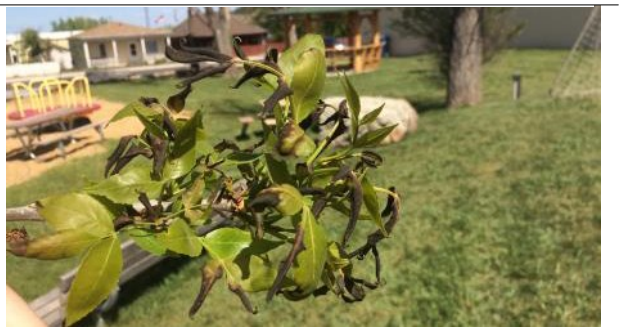
The symptoms can be confusing with other wilt diseases as the symptoms are similar. The most common symptom is wilting and scorching leaves during the hottest and driest time of the summer. While these symptoms can be due to drought, verticillium may only affect a single branch or portion of the canopy, rather than the entire tree wilting. Leaves in the affected area of the canopy may also be stunted.

One of the genera mentioned as susceptible hosts is elms. This past summer a number of elm samples submitted for Dutch elm disease were found to be infected with verticillium. Site visits were made and the affected branches, ones with yellowing and browning leaves, also showed sharply reduced shoot growth for the past couple of seasons which is not typical of Dutch elm disease. The sapwood also did not have the characteristic streaking of Dutch elm disease. Verticillium wilt can show streaking but this is often much fainter than what is seen with Dutch elm disease.

Forest Health Conditions with Other Damaging Agents

Late Frost Damage

The frost caught many ash and hackberries trees just as the leaves were coming out. Trees, such as lindens and maples which already had their leaves hardened off were not affected nor were oaks which had not even opened their buds yet. When this happens, as it has in past years (2009 and 2010), the ground was soon littered with small, partially developed leaves that had blackened margins. While it appeared alarming, affected ash and hackberries put out a second flush of leaves by midsummer.



Frost damage on an ash tree in Rapid City, SD. (RCF service forester, Joshua Larson, 2016)

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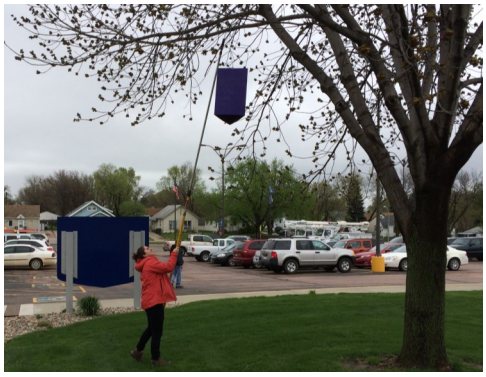
Emerald ash borer readiness

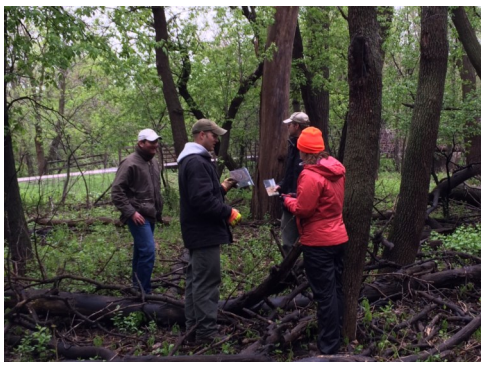
Although the emerald ash borer has not yet been detected in South Dakota, RCF, partnering with numerous other state, federal and local agencies, is committed to preparedness and providing a timely response when EAB does show up. Every year RCF forest health staff reviews, and revises when necessary, the *South Dakota Emerald Ash Borer Readiness Plan*. This plan identifies all the partners and their roles in EAB response, including who will act on the technical team vs the communications team, as well as how the State will respond, manage, and monitor the infestation.

In April of 2016, Dr. John Ball coordinated and facilitated a workshop for representatives from agencies responsible for EAB response in Sioux Falls, SD. This workshop included classroom training sessions as well as an exercise on identifying infested trees in the field. These sessions included:

- Identifying common signs and symptoms of EAB;
- Available preventative treatments for susceptible ash trees and when to treat;
- Proper disposal of trees confirmed with EAB infestation;
- Techniques for trapping EAB and branch sampling suspect trees;
- Protocol for submitting suspect samples of EAB;
- How and when to initiate a delimiting survey;
- Protocol for reporting an EAB confirmed find.



Nicole Pyser, Forest Health forester, demonstrates how to hang an EAB trap (SDDA, 2016)



Team inspects symptom card placed on ash tree during field exercise (SDDA, 2016)